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ABSTRACT

This paper addresses those characteristics of effective and efficient hypermedia presentations that are important for consideration by educators in developing and/or selecting such presentations. Definitions of hypertext, hypermedia, and multimedia are provided, and the relationships among these terms are described. Four other terms useful to developers and users of hypermedia presentations--characteristic, interactivity, presentation, and user--are also defined. Characteristics of a hypermedia presentation are then discussed. The following topics are addressed: (1) content quality, including accuracy, completeness, distraction, need, special/political considerations, and structure; (2) design quality, including color, image size, user control, media (text, animation, audio, video, images), navigation, record keeping, security, and pacing/timing; and (3) operation quality, including audience, costs, feedback, methods of delivery, objectives, preparation/delivery platforms, rewards, and setting. (Contains 28 references.) (JAK)

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Characteristics of Hypermedia Presentations

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Wiley B. Lewis

Preface

Computer-based training [or education] is a proven method for delivering high-impact, cost-effective educational solutions. More and more education, instruction, and training development organizations are utilizing state-of-the-art authoring technology, storyboarding and digital storytelling techniques to design and create comfortable, positive learning environments where the learner is engaged through meaningful scenarios and activities. The learner's retention increases substantially as the subject matter becomes more meaningful and non-threatening.

Yet creating hypermedia presentations takes more than just the right hardware and software. Because learners will be relying more and more on computer-based training [or education] to acquire or refresh skills, the interactive courseware developer should establish and adhere to a set of specifications that will be the standard through the design and development of the graphical user interface for each interactive course or lesson. (Thibodeau, 1997, p. 84)

Research results "have shown that the design of the human-computer interface can make a substantial difference in learning time, performance speed, error rates, and user satisfaction" (Thibodeau, 1997, p. 85). Results have indicated that computer-based media can deliver content at least as effectively as traditional instruction. "The interactive courseware developer should focus on the individual learner, build in active participation, and provide both positive and negative feedback" (Thibodeau, 1997, p. 85).

The writers of this document undertook its preparation because they believe as did Desberg (1994) when he wrote:

... I strongly believe that educators should be developing [instructional] software rather than leaving it to programmers. We are on the front lines from day-to-day working with students. We know how to present information to students, how to stimulate them, and even how they think when they do not get it. (p. x)

In addition, the words of Vannevar Bush (1945), science advisor to President Roosevelt, seemed to apply equally well to the current usage of the term hypermedia relative to education. Bush wrote that

There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers--conclusions which he cannot find time to grasp, much less to remember, as they appear. . . . A record, if it is to be useful to science, must be continuously extended, it must be stored, and above all it must be consulted. (pp. 101-102)

To assist educators, the information in this document addresses those characteristics of effective and efficient hypermedia presentations which have been suggested as being important for consideration by educators in developing and/or selecting such presentations. The contents were designed to depict desirable hypermedia characteristics as well as less desirable characteristics. A copy of this document and its accompanying specially prepared electronic book of a hypermedia presentation available in a runtime version for use on IBM-compatible computers can be downloaded from the following Web site by using a browser.

http://lamar.colostate.edu/~wblewis/AVA_presentation/

The electronic book available for downloading is designed around the concepts expressed in this document and reflects both desirable and undesirable characteristics of a well-prepared hypermedia presentation. Parts of the book do not conform to the desired characteristics specified but were included to demonstrate some of the capabilities of hypermedia presentations.

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Introduction

An increased emphasis on the use of recent technologies--particularly computers--along with the rapid developments in computer hardware and software have enabled educators to make greater usage of hypermedia packages in preparing and using presentations in educational environments. These packages have made it possible to format information to be presented into small units called frames or pages. Each frame or page is then displayed as a one-screen image. As a result, the packages enable developers to provide links for the users--whether an instructor or a learner--to influence the presentation sequence and pace. Multimedia data forms including text, still images, moving images, audio, and computer software programs are often used as part of presentations prepared using hypermedia packages.

It has been shown that certain characteristics are indicative of effective and efficient hypermedia presentations. Educators should recognize those characteristics which are desired in hypermedia presentations as well as those which are not desired so as to facilitate the development and/or selection of such materials.

In the remainder of this document an attempt is made to do two things. First, definitions of selected terms which have been identified as relevant to a discussion of hypermedia presentations are specified. Second, some of the characteristics which should be considered in developing and/or selecting effective and efficient hypermedia presentations are identified.

What is a Hypermedia Presentation?

*What's in a name? that which we call a rose
By any other name would smell as sweet.*

Shakespeare
Romeo and Juliet

A review of the related literature shows that three terms tend to be used interchangeably--multimedia, hypertext, and hypermedia. Smith (1993) reported that "The expressions *hypertext*, *hypermedia* and *multimedia* are confusing and precise definitions tend to be evasive" (p. 23). It was noted by Nielsen (cited in Picher, Berk, Devlin, & Pugh, 1991, p. 23) that "Being multimedia is not quite enough for a program to be hypermedia." "Defining hypertext is much like describing beauty: part of it is in the eye of the beholder" was suggested by Franklin (1989, p. 37). Picher, Berk, Devlin, and Pugh (1991) were more specific when they wrote:

The term multimedia is one of the most overhyped in today's computer vernacular. Any application that manages to create even the most rudimentary mixture of text, pictures, or sound is likely to be dubbed by its marketers as a multimedia application.

The term hypermedia suffers with the same affliction. Most of the popular hypertext authoring systems on the marketplace today claim the ability to add still and moving graphics, audio, and software to the mix. Books have always had pictures in them--are they hypermedia too?

A computer program that runs in color with few pictures and beeps is not necessarily a multimedia application; a multimedia application is not necessarily a hypermedia application. . . . we reserve the term hypermedia for those applications that allow users to forge their own nonlinear paths through images, sounds and text.
(p.23)

Other authors such as Abrams (1996) and Liedtke (1993) support the belief that the terms mean different things to different people. While many of the authors proceed on the bases of their own definitions for the various terms, there are enough similarities among the available definitions for the writers of this document to suggest relevant definitions. Definitions for the most important terms which were perceived to impact this document are presented below.

Multimedia--is the combined use of several media such as movies, slides, music, and lighting , especially for the purpose of education, work, or entertainment. Alber (1996) suggested that "A complete multimedia environment would engage all five human faculties--sight, sound, touch, smell, and taste" (p. 6). According to Holsinger (1994), "... multimedia *incorporates* every type of media ever developed" (p. 3).

Hypertext--Nielsen (1990) suggested that "The traditional definition of the term 'hypertext' implies that it is a system for dealing with plain text" (p. 5). However, he noted that:

Hypertext presents several different options to the readers, and the *individual* reader determines which of them to follow *at the time of reading* the text. This means that the author of the text has set up a number of alternatives for readers to explore rather than a single stream of information. (pp. 1-2)

He suggested that the real issue in distinguishing "traditional text" from "hypertext" "is the extent to which the user is allowed to determine the activities of the system" (p. 10). Hackbarth (1996) reported that hypertext was "non-linear organized and accessed screens of text and static diagrams, pictures, and tables" (p. 229).

The National Education Association (NEA) (1994) on the other hand reported that hypertext was the "Electronic non-linear access and retrieval of text" (p. 20). The organization reported that "Hypertext is like hypermedia except that the product only contains units of text" (p. 20).

Hypermedia--is the combined use of more than one digitized media (text, still pictures, moving pictures, computer software, or audio) in an interactive format. Bielawski and Lewand (1991) defined hypermedia and noted the interactivity by writing that hypermedia was an "information management tool that links text, graphics, sound, or other types of media in an associative way. In doing so, it allows users of a system to navigate through information in a nonlinear format" (p. 41). Nielsen (1990) reported that "... some people prefer using the term *hypermedia*, to stress the multimedia aspects of their system ... " (p. 5)

as opposed to using the term hypertext. The NEA (1994) used the term multimedia rather than hypermedia noting that "the terms multimedia and hypermedia are often used interchangeably" (p. 20).

Considering these comments, the writers elected to define the three terms as follows.

Multimedia is the *combined use of several media* such as movies, slides, music, and lighting, especially for the purpose of education, work, or entertainment. A multimedia presentation then can have the capability of *operating either in a linear or nonlinear fashion* and *may or may not be designed in an interactive format*.

Hypertext is a system in which the *electronic nonlinear access to and retrieval of text and static diagrams, pictures, and tables* are available to the user so that the user is allowed to determine the activities of the system.

Hypermedia is the combined use of *more than one digitized media* (text, still pictures, moving pictures, computer software, or audio) in an *interactive format*. The user can access various elements of the presentation in a nonlinear sequence.

The relationships among the three terms are depicted in Figure 1.

In addition to the three terms defined above, the writers believed that definitions of four other terms would be useful to both developers and users of hypermedia presentations. These terms are characteristic, interactivity, presentation, and user.

Characteristic--is a distinguishing trait, quality, or property of a set or class. The writer's have used the term in relation to the traits, qualities, or properties of hypermedia presentations.

Interactivity--is the ability of the user to cause things to happen or to interrupt the flow of information in a program (Abrams, 1996, p. 14). The following proverb cited by Liedtke (1993, p. 9) supports the incorporation of interactivity into a presentation.

*Tell me and I'll forget;
show me and I'll remember;
involve me and I'll understand.*
Zen Proverb

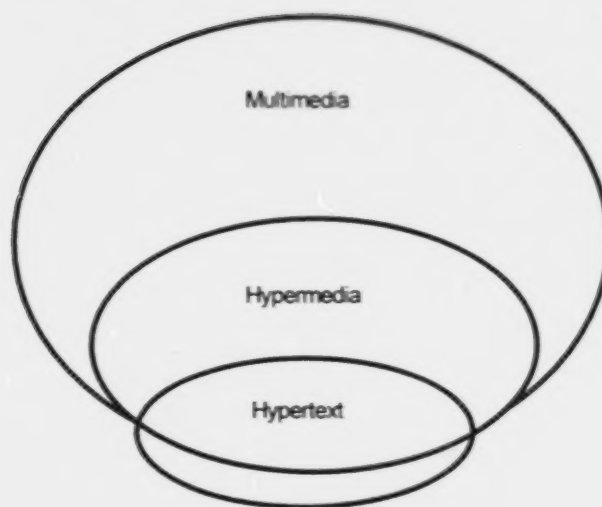


Figure 1. Relationships among the terms multimedia, hypermedia, and hypertext (adapted from Hackbarth, 1996, p. 229).

Presentation—Two of many definitions for "presentation" are something set forth for the attention of the mind or something brought to one's attention. Since either or both definitions reflect the purpose of most educational activities, the writers used the term throughout this document to reflect the delivery of information or skills to other individuals.

User—is an individual who delivers or participates in a hypermedia presentation. In terms of the writer's use of the term, "user" refers to anyone who employs a hypermedia presentation in setting forth something for the attention of one's mind or in an effort to bring something to one's attention. In relation to this definition, a "user" may be an educator or a learner if he/she is directly involved in the operation of the presentation devices.

The writers have attempted to use the several terms identified above consistent with the definitions provided. For example, the term "hypermedia" is used throughout the document except in direct quotations from authors who do not distinguish between or among two or more of the terms "multimedia," "hypertext," or "hypermedia." It was the writers' belief that greater specificity in the use of terms would assure that the reader would more easily understand the intent of the passages.

Characteristics of a Hypermedia Presentation

Wolfgram (1994) stipulated that there were four rules which should be followed in preparing a good presentation. His first rule for a good presentation was that "The message must be delivered, or the production is a waste of time and money" (p. 10). He suggested that the following adage was one that should be observed.

Tell 'em you're gonna tell 'em, tell 'em, tell 'em ya told 'em. (p. 11)

The second rule for a good presentation, according to Wolfgram (1994), was that "*Entertainment* is defined as the stimulation of any emotion or set of emotions that can be classified as positive in nature." He suggested that for a presentation to be well received, there should be some positive aspects and humor included as part of the presentation. Furthermore, he issued a concern noting that "All of the communication and entertainment you can throw at an audience is of no value if they don't remember it" (p. 12). He reported that "People remember only about 15% of what they hear and 25% of what they see, but over 60% of what they interact with" (p. 12). In relation to retention, people also tend to remember that which they encountered last. Thus, in the "*tell 'em you told 'em*" section of a presentation one should place major emphasis on the most important element of the presentation.

For his third rule, Wolfgram (1994) stated that "The tools and skills required to create a good presentation are so plentiful that there is no excuse for settling for less than the highest quality execution" (p. 13). While the writers of this paper support the thoughts in this statement, there may be some major limitations. While high quality in such areas as design, copy writing, and illustration is generally relatively easy to attain, performance of the hypermedia presentation may be an entirely different matter. Two factors in particular are difficult to control, especially when the user is an individual learner. While a presentation can be prepared with a user profile in mind, that profile may differ from the profile of the actual user. In addition, differences in hardware and software characteristics or other factors in different educational environments may have a major impact on the performance of any hypermedia presentation.

In his fourth rule for a good presentation Wolfgram (1994) wrote that "The effectiveness of the presentation must be measured and analyzed" (p.15). Both the developer of hypermedia presentations as well as those that utilize such presentations should feel the need to measure the success of each presentation. This might be addressed by determining if members of the audience took action as suggested in the presentation, by collecting data from the participants as the presentation progresses, or by conducting follow-up activities with representatives of the audience to determine if they found the content(s) of the presentation to be of value.

Considering Wolfram's (1994) rules along with remarks by other authors reporting on the use of hypermedia presentations, it was decided that the relevant characteristics could be grouped into three categories--content quality, design quality, and operation quality. The various characteristics are discussed below as they relate to each of the categories. These characteristics should be considered in developing and/or selecting such media.

Content Quality--The degree of excellence or superiority in kind of the subject or substance dealt with in a hypermedia presentation

The writers found the comments of Zemke and Armstrong (1996) to be of paramount importance in reference to this category of characteristics. They wrote:

It is easy to become so enamored of the bells and whistles of multimedia that you lose sight of instructional and informational goals. So make content gate No. 1: If the content you need isn't there, nothing else matters. Period.
(p. 50)

With this thought and Wolfram's (1994) first rule in mind, six specific elements were identified as impacting the content category. These elements are discussed below.

Accuracy--This concept, supported by Zemke and Armstrong (1996), suggests that the correctness or freedom from mistakes and errors of the content must be considered.

Completeness--Zemke and Armstrong (1996) suggested that one must consider whether the presentation has the depth of information that the members of one's audience needs. This does not mean that the content(s) must be exhaustive, but that the parts, elements or steps necessary to achieve the objective(s) of the presentation are present and up to date.

Distraction--Care should be taken to ensure that the attention of members of the audience are not diverted away from the intent of the presentation or that they are not confused with conflicting emotions or motives. For example, Thibodeau (1997) reported that while humor might be used "to increase learner interest and to promote recall, it can also backfire and distract from content" (p. 85).

Need--Often defined as something requisite, desirable, or useful or as a condition requiring supply or relief, one must determine the level or

degree of need for having hypermedia presentation material related to a specific topic. In certain instances, presentation materials which do not reflect all of the characteristics described in this document may be considered useful if no other materials of higher quality are available.

Social/political Consideration--Careful thought should be given to content or relating to the interaction of the individual and the group or the welfare of human beings and the government to determine if it is acceptable. For example, Thibodeau (1997) suggested that one should avoid the use of biases or stereotypes in graphics, animations, and text as they might impact concerns related to gender, ethnicity, religion, etc.

Structure--Consideration should be given to the arrangement of the content(s) and how that arrangement fits with one's overall plan for delivery related to the topic. For example, does the structure support one or more theoretical bases for education such as that of behavioral modeling theory (Arends, 1998) or constructivism (Boyle, 1997; Hackbarth, 1996)? In a more general mode, does the hypermedia presentation utilize the concept of chunking--the segregation of the concepts one is dealing with and the development of short, focused documents about each concept as recommended by Pfaffenberger (1997)?

Design Quality--The degree of excellence or superiority in kind of the conceiving, planning, and arranging of the elements in a hypermedia presentation

Wolfram (1994) suggested that the developers of such presentations should use a consistent style. That is, the developer should utilize a distinctive manner of expression or a particular manner or technique by which something is done, created, or performed or a distinctive quality, form or type of something. Such consistency not only makes the overall development of a presentation easier but assists the user since the operations performed in using a particular presentation would be consistent.

Color--While color has been shown to have a positive impact on the members of the audience in terms of holding their attention and promoting retention of the content(s) of a presentation, there are a number of concerns regarding the use of color. Pinheiro (1996) suggested that an excessive number of colors should not be used. In 1997, Trautman recommended that no more than 10 colors should be incorporated into a presentation. In addition, the color of backgrounds should be selected carefully so as to enhance the presentation, not overpower the viewer (Trautman, 1997). Another concern related to color has to do with the hardware and programs used to support the presentation. As viewed by a

user, colors assigned to various elements of the presentation may vary from program to program and from display device to display device.

Image Size--In creating an image, the developer should take steps to ensure it will be sufficiently large to permit users to feel comfortable in dealing with the level of detail which is required but yet will operate on the available hardware. Minute details may require that enlarged sections of an image be displayed while images with few small details can provide more of an overall view. It was suggested by Pinheiro (1996) that less than half of the available screen space should be used for specific images. Image-free screen space should be provided for the viewer's benefit.

User Control--The user of a hypermedia presentation should be able to guide or manage the operation of the presentation as this will tend to minimize any possible frustration levels and to enhance the user's interest in the presentation's content(s). The items listed below are believed to have a positive impact on user control if the expressed concepts are incorporated into the presentation.

1. Break the content down into small units. Build in questions with positive and negative feedback. Allow the learner an opportunity to review sections and don't forget to provide a summary of the material for that unit of instruction. By alternatively and randomly moving from content to practice to summary, one keeps the learner from becoming annoyed or bored and helps to facilitate learning. (Thibodeau, 1997, p. 85)
2. Provide an opportunity for interaction every 3-5 screens, or every minute or two to avoid building an overpriced, electronic "page turner." (Thibodeau, 1997, p. 85)
3. Questions asked should follow content just presented. The questions should be based upon previously acquired knowledge. Jumping right into the next content area without this opportunity is monotonous to the learner. (Thibodeau, 1997, p. 85)
4. Questions should provide an occasion to utilize what students have learned rather than just memorizing and reciting answers. (Thibodeau, 1997, p. 85)
5. Questions should be used often. They sustain learner's attention by keeping them involved in the learning process. (Thibodeau, 1997, p. 85)
6. Consider designs where the learner is not presented with information in a linear format, rather, he or she "discovers" information through active exploration. With some tasks, such as problem solving, learning through discovery promotes understanding and retention because new knowledge is linked to existing knowledge. (Thibodeau, 1997, p. 85)

7. Never use timed screens . . . let the student control when to proceed.
(Pinheiro, 1996, p. 131)

8. Always make it clear as to how the learner is to provide input.
(Pinheiro, 1996)

9. Are the screens easy to understand, appealing and usable?
(Pinheiro, 1996)

10. Can material be reviewed? Are there help screens available for use?
Can the user control the pace of the presentation? (Zemke & Armstrong,
1996, p. 5)

11. The key here is that the student must do something. We know from
educational research that learning involving "doing" is retained longer
than learning via listening, reading, or seeing. But to some extent, all
media involves interactivity. What we really want to think about is the
level and quality of the user's interaction. . . .(Abrams, 1996, p. 14)

12. Interactivity is the most powerful of the emotion inducers available to
us in multimedia presentation. . . . A study done in the late 1980s
showed that we remember up to 70% of what we interact with. Proper
use of interactivity results in the user retaining information you delivered,
which is the ultimate goal of any presentation. (Wolfgram, 1994, p. 71)

Media--The means of effecting or conveying content(s) in a hypermedia
presentation are very important. In reflecting on this area of concern,
Zemke and Armstrong (1996, p. 51) suggested that the following
questions be considered.

1. Is the use of multiple media purposeful or just stunt-flying?
2. Do the media elements work together smoothly or do they compete for your
attention?
3. . . . how well are they integrated?

In addition, consideration should be given to the programs and hardware
which will be available to potential users of the presentation. Many
educators have found that though they have access to excellent
presentations, those presentations cannot be easily used in the available
educational environment.

Information related to various types of media should be considered in
preparing hypermedia presentations.

Text--The written or printed matter on a page or screen should
adhere to certain guidelines for a presentation to be effective and
efficient. Since a great deal of work has been done related to this

area, numerous recommendations and comments related to text are presented below.

1. Two types of text—static and live are identified by Cooper, Schlachter, & Watson (1996).

a. Static text words are usually designed to look their best on the screen and laid out to fit in well with their graphical surroundings. Static text has one major drawback: design considerations are paramount, and the text is always limited to a single screenful. (Cooper, Schlachter, & Watson, 1996, p. 122)

b. Live text, however, overcomes these limitations. Live text takes the form of a database of linked articles, offering a wealth of information, from which you can access related subjects. On-screen it appears as a work processor file, through which the user can scroll for page after page, clicking on any word to obtain further information, to pursue an associated topic, and so on. In this way, it is much more interactive than static text. (Cooper, Schlachter, & Watson, 1996, p. 122)

2. The print quality of the type you are reading now is more than thirty times better than it would appear on a computer monitor. (Cooper, Schlachter, & Watson, 1996, p. 123)

3. Most book designers use serif typefaces or lettering styles . . . which have small cross-lines (serifs) at the end of each stroke of a character. Serifs generally make text on the printed page easier to read. (Cooper, Schlachter, & Watson, 1996, p. 123)

4. On-screen, however, san serif typefaces . . . are much easier on the eye, and many screen designers opt for them. This is because of the pixels, the small elements that make up a screen, are square, which makes curved or elaborate letter shapes appear blocky. In the industry terminology, such letters have the "jaggies," and serif typefaces are especially prone to jaggies. (Cooper, Schlachter, & Watson, 1996, p. 123)

5. Some designers combat the jaggies by using a technique known as antialiasing, which blends the jagged edges into their surroundings. If, say, the type is black on white, the designer fills in the pixels surrounding each letter with shades of gray, which gives the edges of the letters a much softer appearance. However, antialiasing can only be used for larger type sizes. (Cooper, Schlachter, & Watson, 1996, p. 123)

6. Limit the amount of text on the screen. It is more difficult and takes longer to read text on a screen than in print. People read text on a computer screen 28 % slower than if reading from a book. (Thibodeau, 1997, p. 85)

7. Position text appropriately. Regular text should be left-justified only. Center heading and titles. Do not hyphenate words at the end of lines. (Thibodeau, 1997, p. 85)

8. When formatting screens, the following techniques might be useful:

- ◆ Provide a generous amount of white [blank] space to separate blocks of information.
- ◆ Use headings as content summaries and navigation aids.
- ◆ Convert sentences containing serial items to lists.
- ◆ Organize complex information into tables to help learners integrate program content.
- ◆ Reserve the use of all upper case letters for adding emphasis and to titles only. (Thibodeau, 1997, p. 85)

9. Attention getting techniques include:

- ◆ Limit highlighting or boldfacing to 10% of the screen display.
- ◆ Reserve italics for titles or headings.
- ◆ Use reverse video or blinking with discretion. Text to read should never blink.
- ◆ Make use of mixed type sizes or fonts to contrast screen components.
- ◆ Use no more than one attention-getting technique per screen display. Keep in mind that overly saturating the screen reduces the effectiveness of the attention-getting technique. (Thibodeau, 1997, p. 85)

10. Verify the appropriateness of the colors used for text under simulated presentation conditions. The clarity of text colors will vary depending on such factors as the screen background colors, room lighting and the proximity of students to the screen. (Thibodeau, 1997, p. 85)

11. The basic rule is . . . less text, greater legibility. (Desberg, 1994, p. 24)

12. Use no more than one or two fonts per presentation. (Trautman, 1997)

- ◆ Bullets can take different forms.
- ◆ All uppercase letters are boring.
- ◆ Multi-color text may be circus-like.
- ◆ No script fonts.
- ◆ 10 colors only in one presentation.
- ◆ Contrasting colors help the eye to focus.
- ◆ Size of text:
 - Body = 24 - 30 points;
 - Subtitles = 36 - 45 points; and
 - Titles = 48 points and up.

Animation--The act of moving to action, especially giving an inanimate object movement or activity, is an effective technique which has proven very useful in the preparation of hypermedia presentations. However, Wolfram (1994) emphasized that one should only animate an object when such movement has a specific purpose in the presentation. He suggested that animation might be used to "Enhance emotional impact," "Make a story point," "Improve information delivery," "Help with the passage of time," or "Provide a transition to another section of the presentation" (pp. 67-68).

Audio--Three categories of sound are often used as part of hypermedia presentations: music, sound effects, and narration. According to Wolfram (1994), each of the categories should be used only when it enhances the presentation. He suggested that music sets the mood, enhances the emotions of an important segment, or illustrates particular points in the presentation. Sound effects, on the other hand, should be planned to enhance the presentation--never used just for background noise. Narration--the human voice or a representative sample thereof--helps the audience to relate to the contents of the presentation.

Video--Recorded or live images displayed through a television or computer screen are, according to Wolfram (1994), best used when a particular point can be made only with video. He reported that the decision to use video was one of the most difficult for the developer because of differences in hardware and software which might be used to support the presentation. For example, video images saved as electronic files require a large amount of storage space. Will the user have sufficient storage capacity to handle the storage of such files? Decisions relative to extensive uses of such files are crucial as the developer often has little control over the environment in which the presentation is used. One last suggestion from Wolfram (1994) was "Don't sacrifice message delivery for technology's sake" (p. 81).

Images--Reproductions or imitations of the form of a person or thing play a large role in many hypermedia presentations. Trautman (1997) recommended that images be of good quality; relevant, not just a time killer; up to date; suited to the audience; and suited to the developer's purposes. She also suggested that the images should add to the presentation; add variety; change focus; or add interest.

Howles and Pettengill (1993) stated that progressive disclosure might be used to advantage if one needs to illustrate a complex concept by including a lot of pieces of information on a single screen, gradually revealing the information. Use of this technique enables the viewer to focus on one critical idea at a time and not get distracted by other informational elements on the screen.

Navigation--This concept, which is at the very heart of hypermedia presentations, refers to how one progresses through a *nonlinear* presentation. Wolfgram (1994) wrote that a viewer must always know where he/she is, how he/she got there, and how to proceed from there to somewhere else. If not, the developer has lost the viewer. Successful message delivery depends on keeping the viewer's attention focused on the subject. If the viewer has to spend time figuring out where he/she is, he/she will lose track of the main message he/she has been receiving.

Another aspect of navigation deals with how input devices are used to interact with the material presented. This depends heavily on conventions that the developer establishes early in the production of the presentation.

"A convention is nothing more than determining a specific way of doing things and then sticking to that determination" (Wolfgram, 1994, p. 104). For example, buttons and menus should be in the same place on the screen throughout the presentation. These are simple conventions that will help a user learn the system so that valuable time is not wasted in figuring out what to do next. Use standards established by others where they are available

Menus are often used as a visual aid to navigation according to Wolfgram (1994). He suggested that menu items or buttons be darkened to show that that option has already been selected and that no inactive menu items or buttons be displayed. He also recommended that the number of choices on any single menu be limited to five or fewer.

Hyperlinks, devices that provide the viewer with a means to quickly access any information that is of interest, was reported by Wolfgram (1994) as being used more as an indexing system than as a navigation tool. A developer should use a hyperlink only to link related information. It has been observed that hyperlinks are often overused. It was suggested that the links should be made to stand out against non-linked objects by using a different font or color.

Regardless of the techniques used to move through a hypermedia presentation, Pinheiro (1996) suggested that one always provide

opportunities for the user to navigate to all relevant parts of the presentation.

Record Keeping--Often there is a need to store in some manner evidence that particular activities took place or that a particular level of performance occurred. The individual designing hypermedia programs must decide what type information will be retained regarding a user's activities and performance. This has become very important with the learner taking greater control of a presentation as it became necessary that detailed records be maintained to ensure that the individual got the most from the presentation. As an educator having individual learners use hypermedia presentations, one needs to ascertain if the necessary records will be accessible for determining whether an activity was completed or for completing a learner assessment.

Security--This refers to measures taken to ensure that the content(s) of the presentation are not altered or guard against the unrestricted release of private information such as a learner's grade or performance evaluation and to prevent the unauthorized tampering with the accuracy of such information. In the latter case for example, if a presentation used by a learner tracks the learners' responses to quiz items and those responses are recorded, is it possible for that or another individual to change the data so a true record is not reflected?

Pacing/timing--The total time required for using a prepared presentation and the speed with which a presentation can be usefully completed should be of concern in the development and/or selection process. Wolfgram (1994) suggested that one should determine the length of time that the presentation will run before getting into detailed design of the presentation. He defined this running length as including both the length of each section and to the total running time. He stressed that each section of the presentation should run no longer than necessary to make a particular point.

As general recommendations regarding the total running time of presentations, Wolfgram (1994) suggested the following:

2 - 3 minutes -- self-running presentation;

5 - 6 minutes for presentations with some limited interactivity; and

15 minutes for a completely analytical, hands-on presentation which includes some vehicles to make sure that the viewer comes back to the presentation again and again.

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The presentation should be designed so it keeps moving. While moving things along as quickly as the system will allow is a viable goal, Wolfgram (1994) stressed that should be done only as long as the message delivery is not compromised by the pace. He also noted that transitions between slides or sections should also be an indication of real time, where appropriate. For example, in a storytelling presentation, slow dissolves might be used to indicate a time delay while quick cuts might be used to show two views of the same scene at the same moment in time.

In trying to plan for adequate time allowances, slowly reading a block of copy twice is a good way to determine how long to allow for a viewer to read it. As a developer, one will often underestimate the amount of time which will actually be required for using a presentation because of one's familiarity with the presentation.

Wolfgram (1994) suggested that the only proven vehicle for getting any user to last more than 15 minutes is a highly interactive situation involving user control with lots of feedback, such as a game or financial analysis program. This can be an effective implementation, but in most cases it is better to limit oneself to a 10-minute presentation with gimmicks that promote multiple viewing sessions.

Operation Quality--The degree of excellence or superiority in kind of the performance or function of a hypermedia presentation in a practical setting

Audience--This addresses whether a particular presentation is suitable for the users to be impacted by the presentation. Some of the questions which should be considered are:

1. What are the characteristics of the individuals with/by whom the presentation is to be used?
2. Will those individuals be able to benefit from the presentation with minimum preparation in terms of program usage or providing prerequisite knowledge and skills?

This is an important area of concern as indicated by Smith's (1993, p. 72) citation of Hooper's (1990) writings. Hooper wrote that

Some individuals learn well using paper and pencil or from viewing linear movies or other narratives yet, other individuals learn much better from more sensory media. . . . Research suggests that multiplicity of sensory media available can be used significantly for critical educational effect. (p. 14)

Smith (1993, pp. 72-73) put further stress on the importance of the members of the audience when she wrote:

... No one tool can please everyone. "Hypertext is intended to appeal to one's intuition—to be simple to create and to access" (Rada, 1991, p. 676). But many students work outside this approach. "Not all children learn in a logical progression ... rather picking up some isolated fact to add to an unrelated collection of knowledge. Only later do they begin to see relationships among those facts" (Bradsher, 1990, p. 314). This comment results from observations in traditional settings. Hypermedia situations could potentially increase this problem.

Grabowski and Curtis (1991) discuss some concerns of using hypermedia systems for learning new concepts. They praise the potential information base that can be easily included into the system.

Hypermedia systems respond well to what you want to know but largely ignore how, why, and in what form you need to know it, what you know (or don't know) already, what you anticipate finding, how it will help you, or what your problem looks like. (p. 6)

Smith (1993, p. 73) also wrote that

While Grabowski and Curtis are strongly supportive of the potential of hypermedia, they do suggest some caution. Teachers that use the library research approach in their classrooms realize the difficulty of determining what outcomes have been achieved. Hypermedia presents a similar debate. "This is not intended to imply that learning does not or will not occur; it simply illustrates that we do not yet know how, for whom and under what conditions it will or will not occur" (Grabowski & Curtis, p. 10).

Costs—Costs, expressed either as funds expended for the acquisition of a presentation, the revision of a presentation, the establishment of an environment in which the presentation can be used, the training of personnel to use a presentation, or the foregoing of the acquisition or repair of other equipment or the performance of other activities to implement a presentation, must receive adequate consideration.

Questions such as those expressed below should be considered.

1. Can the costs associated with developing, or acquiring and presenting the program be covered?
2. Will special components—either hardware or software—or educational settings be necessary for using the presentation?

Feedback--This concept refers to the evaluative or corrective information transmitted to the developer or user about an action, event, or process as a result of one's interaction with a hypermedia presentation. This is closely associated with record keeping as reflected in another part of this document but also reflects immediate on-screen responses such as text messages and off-screen responses such as sound provided during the actual operation of the presentation.

Method(s) of Delivery--Most educators plan for the method(s) or process(es) to be used in sending the desired content(s) to the intended audience. Knowing one's intended mode(s) of delivery, does the presentation contribute to that effort? While it appears that an educator's belief in and devotion to the effectiveness of a particular delivery effort enhances the possibility of success, the use of an inappropriate presentation might have adverse effects.

Objective(s)--In any typical educational setting, there are several areas toward which effort is directed. An educator often has objectives expressed in terms of what the learner is expected to acquire or achieve. In addition, most educators have objectives which address the concern "this is what I want to achieve or do today." Also, there may be objectives related to administrative concerns such as how well will the presentation contribute to the achievement of the various areas of objectives. Some questions related to this concern as specified by Zemke and Armstrong (1996) are listed below.

1. Will the presentation address the topics of concern to you?
2. Is it meant to transfer knowledge, to motivate the individuals, change attitudes and offer insights, provide performance support as an on-line reference, certify the user's level of learning, or track individual's use of and performance on the program.

Preparation/delivery Platform(s)--The medium through which a presentation is to be displayed or prepared for display should be given careful consideration. Since all platforms do not support the same version or types of presentation programs, it is important that consideration be given to the types of media available. Two questions which should be considered are listed below.

1. Will the presentation operate on currently available devices or will the purchase of additional hardware/software be required?

2. Will the presentation be used by a presenter in a classroom setting or by individual users in an office, computer laboratory, or home study setting?

Rewards--Reinforcers or incentives such as recognition, points, grades, or symbols provided a user to encourage and strengthen desirable performance or other action should be incorporated into a presentation.

Setting--The time and place including any equipment, supplies, and furnishings in which the presentation is intended to be used should be considered. A basic question which should be answered is "Will the presentation be useful in the type(s) of environment(s) in which it is intended to be used?"

The writers believe that all three categories of characteristics--content quality, design quality, and operation quality--are important. Though, as suggested in this document, content may theoretically be the most important, the other categories cannot be neglected. A presentation with excellent content qualities that does not operate properly or is poorly designed from a learning point of view may distract from the delivery effort to the extent that use of the presentation is unproductive. A well-prepared presentation should reflect the characteristics described for each of the three categories. Zemke and Armstrong (1996) wrote this about the type of presentation which should be developed and/or selected.

... first you need a program that runs, delivers the content you promised, and makes your audience ask for more. ... guidelines won't guarantee a success, but they will help you avoid failure. (p. 52)

Concluding Thoughts

Rather than recap the information presented earlier in a detailed format, the writers have taken this opportunity to relate some of their beliefs concerning hypermedia presentations which they consider to be important in making decisions relative to the development and/or selection of such presentations. In most cases, these beliefs are expressed in the words of authors who have given extensive consideration to the concepts and expressed the beliefs in a communicative manner.

First, the use of hypermedia presentations is not the answer to all educational concerns.

Because a lesson [or presentation] utilizes multimedia technology doesn't necessarily make it superior to traditional instructional methods. . . . the key to any effective learning experience lies in the instructional design. When you combine sound instructional design principles with state-of-the-art teaching tools, only then will the true potential of multimedia in education becomes [stet] fully realized. (Howles & Pettengill, 1993, p. 61)

. . . Multimedia training can't do everything. A canned program, regardless of how cleverly designed, can't develop spontaneous interactions, bond with students, synthesize, respond to student inquiries, model behavior and values, empathize and commiserate, work with large-group dynamics, confront, or adapt to changing demands. (Zemke & Armstrong, 1996, p. 52)

Second, the use of hypermedia presentations can help solve some educational problems.

On the other hand, a computerized program can reach hard-to-serve trainees; make information available on demand; and act as a patient, nonjudgmental tutor. A good multimedia program can show trainees complex behavioral models and lead them through an analysis of those models. And when travel money dries up and schedules go into a cocked hat, multimedia training can go forward without a blink. (Zemke & Armstrong, 1996, p. 52)

Third, the development of hypermedia presentations should involve prior planning, getting input from others regarding the effort and the product, and viewing the development as a continuing process--not be limited to a one-time, one-person effort.

Always get feedback from others throughout the lesson design process. Just as any professional writer needs an editor, you, as a multimedia author, will benefit from other people reviewing your work. Remember, you're not creating a presentation for yourself, but for other individuals who are not familiar with your subject material. You want to discover any weaknesses in your lesson design before you present it to a classroom of students. (Howles & Pettengill, 1993, p. 61)

Avoid trying to make your screen displays too perfect the first time around. Fine-tune and polish your screens over several sessions. Some instructors like to create an entire lesson in the form of a rough draft and gradually fine-tune it through successive iterations. (Howles & Pettengill, 1993, p. 61)

Front-end design time spent now will minimize the need to make structural revisions later. (Howles & Pettengill, 1993, p. 61)

Planning time should use between 50% and 75% of the time it takes to produce a complete multimedia project. (Trautman, 1997)

Thibodeau (1997) wrote that "In closing, the bottom line is 'simplicity'" (p. 85). He also noted that one should

Present your message, and only your message. Don't confound it with superfluous graphics, animations, sounds, colors or activities. Be a minimalist in your approach. *Think lean*. Make it a challenge to present your message with as few textual and audiovisual stimuli as possible. (p. 86)

If you make it too lean and learners have trouble understanding it, you will find that out during formative evaluation [Misanchuk & Schweir, 1994]. If however, you put too many "bells & whistles" in your lesson, you will probably never find out about the troubles. All you'll end up doing is using up time unnecessarily --yours and the learners'--as well as disk space. (p. 86)

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